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SECTION OF GEOLOGY AND MINERALOGY

MARCH 6, 1939

DOCTOR EDWIN H. COLBERT, American Museum of Natural History: *The Migrations of Cenozoic Mammals.* (This lecture was illustrated by lantern slides.)[1]

Much of our present knowledge concerning the past distribution and migrations of land mammals is due to the long years of unexcelled research by the late William Diller Matthew, perhaps the greatest of the authorities who have dealt with this fascinating subject. Matthew's definitive essay "Climate and Evolution," originally published in the Annals of the New York Academy of Sciences in 1915, has for many years been the standard reference work on this topic, so that any discussion having to do with the migrations of mammals in past geologic time, and the distribution of mammalian life as the result of such migrations, must of necessity rest to a large extent on the principles so clearly enunciated by Matthew in the above mentioned publication. Fortunately, "Climate and Evolution," together with other papers by Matthew dealing with the

[1] Doctor J. B. Mertie, Jr., of the United States Geological Survey, was scheduled to give an address entitled, "*Geological Features of Alaska,*" but illness prevented his attendance. Doctor Colbert generously served as a substitute.

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same subject, is soon to be republished by the New York Academy in a Memorial Volume, the first of the new series of Special Publications.

At the present time the land mammals of the world are distributed through five great zoögeographic realms, or regions, which are:

1. The Holarctic Region—Eurasia, north of the Himalayas and the Tibetan Plateau; and North America, including a part of Mexico.
2. The Oriental Region—India and Indo-China; many of the East Indian Islands.
3. The Ethiopian Region—Africa and Asia Minor, south of the tropic of Cancer.
4. The Neotropical Region—Central and South America.
5. The Australian Region—Australia and some of the nearby East Indian Islands.

This present-day distribution of land mammals, and incidentally of many other kinds of land life, is attributable to three controlling factors, which have operated through past geologic ages. These are:

1. The original centers at which mammalian orders, families, genera and species had their beginnings.
2. The migration of mammals from these centers of origin.
3. The extinction of mammals subsequent to their migrations.

When we look at a map of the World, as shown by a North Polar projection, it at once becomes apparent that the Holarctic Realm or Region lies within a centrally located land mass, from which radiate the other land masses, containing the remaining zoögeographic regions. It is to be noticed, also, that the land masses most closely connected with this central Eurasiatic-North American block, are those of Africa, including the Ethiopian Zoögeographic Region, and of India and the East Indies, containing the Oriental Zoögeographic Region. South America, which encloses the Neotropical Region, and Australia, in which is included the Region of that name, are more or less completely separated from the central land mass.

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Now it is an interesting fact that the discoveries and studies of early Cenozoic mammals, which have been made during the past fifty years or more, go to show that a preponderant number of mammalian groups—at least in the larger sense of the word—have had their origin in the centrally located, Eurasiatic-North American land mass. That is, a majority of mammalian orders, families and genera are of Holarctic origin. Thus we should expect the present distribution of land mammals to be in part dependent on this fact.

It is evident that the distribution of mammals as affected by the factors of origin and migration is governed to a great extent by the relationships of the continental land masses during past geologic times. Matthew demonstrated very fully that the facts of origin and migration of Cenozoic and Recent land mammals may be explained in accordance with the theory of isostasy, whereby it is supposed that the continental land masses were distributed in past geologic ages much as they are today and that such land bridges or waterways as existed were due to minor vertical oscillations of epeirogenic proportions. Indeed, it is difficult to see how the distribution of land life can be satisfactorily explained in the light of any other theory.

In considering the migrations of mammals from their centers of origin, across and between the continental land masses which were oscillating vertically, but not drifting horizontally, certain principles affecting such migrations must be kept in mind. The first is that increasingly progressive forms arise at the center of origin, due to the necessity of becoming adapted to changing environmental conditions, and push out radially from this center, driving the more conservative and primitive types to peripheral regions. The second is that mammals, for the most part, are freely moving animals, capable of spreading at extraordinarily rapid rates if conditions are favorable, so that migration often times may be virtually instantaneous from the standpoint of geologic time. A third principle is that those mammals which do migrate rapidly, are apt to be progressive types, since their migration is intrinsi-

cally causative and not the result of pressure from still more advanced forms.

These principles of mammalian migration may be well illustrated by the evolutionary development and the past migrations of the Equidæ. This group of mammals was, until the close of the Pleistocene, primarily of North American development, for the horse went through the entire gamut of its evolutionary history on this continent, reaching other sections of the globe by several great intercontinental treks during later Cenozoic times. Thus, during the Miocene period the anchitheriine horses, having their origin from the North American Oligocene genus, *Mesohippus,* spread from the original Nearctic center or origin throughout the Palearctic, or Eurasiatic region. Then, at the beginning of the Pliocene, the genus *Hipparion,* originating in the North American area from a Miocene ancestor, *Merychippus,* spread from its original home to almost all sections of Eurasia, the Orient and Africa. And finally, at the beginning of the Pleistocene, *Equus,* again of North American ancestry, having its origin in the upper Pliocene genus *Plesippus,* pushed to the west to populate Eurasia, the Orient and Africa, and to the south to spread through the South American region.

Migrations such as these may have great significance with regard to intercontinental correlations. This is particularly evident in the case of the Siwalik beds of India, and their relationships to upper Cenozoic strata in other parts of the world. The Siwaliks are, broadly speaking, divisible into three groups, the Lower Siwaliks, often regarded as Vindobonian, or middle to upper Miocene in age, the Middle Siwaliks, often considered as Pontian, or lower Pliocene in age, and at the top the Upper Siwaliks, generally placed at the boundary of and bridging the gap between the Pliocene and the Pleistocene. These correlations are based on the general aspects of the several Siwalik faunas.

But recent discoveries have shown that *Hipparion* is present in the Lower Siwalik fauna. If this genus first appeared

in the New World at or near the beginning of the Pliocene, then its subsequent appearance in the Lower Siwalik fauna must indicate that this fauna is of a later age than it was once thought to be, namely of approximate Pontian rather than Vindobonian affinities. Therefore, the Middle Siwalik fauna must be of post-Pontian age. Likewise, the sudden appearance of *Equus* in the Upper Siwalik beds must be indicative of the Pleistocene age of these deposits, since *Equus* seemingly has its first appearance at the beginning of the Pleistocene in North America.

In view of the foregoing remarks, it is interesting to make a brief survey of the Pleistocene mammals of the Holarctic region, to see what factors have affected the distribution of these forms. In the first place, it must be recognized that the Pleistocene distribution of Holarctic mammals is due, to a large degree, to the heritage of their Pliocene distribution. That is, most of the Pleistocene mammals of the Holarctic region have descended in the same areas in which they are found from Pliocene ancestors. But certain notable exceptions are to be seen. Perhaps the most outstanding of the Pleistocene mammals which have transgressed the areas of their Pliocene heritage are the horses, the camels, the elephants, and the cattle. Of these, the two first named are of North American origin, spreading at the beginning of the Pleistocene to Eurasia, while the latter two are of Old World origin, spreading at the beginning of the Pleistocene to North America. Indeed, the simultaneous spread of these four types of mammals throughout a greater part of the world has often been suggested as a valid criterion for the opening of Pleistocene times, particularly in those areas which show neither glacial nor pluvial phenomena. Yet there have been other extensive migrations during the Pleistocene, that have affected the constitution of Holarctic faunas. The movement of certain lagomorphs, of the bears and of man from the Old World to the New (in addition to that of the elephants and cattle) may be cited. And in addition, there was a mass migration of large edentates from

South America into North America during Pleistocene times, thereby adding an exotic element to the typical northern fauna.

On the other hand, the non-migrations of certain Pleistocene forms are difficult to explain. For instance, why did not the woolly rhinoceros of Eurasia accompany the hairy mammoth into the New World? Certainly it would seem that any conditions that might favor the movement of one of these animals would be conducive to the migration of the other.

Finally, the factor of extinction has worked in conjunction with those of origin and migration to make the faunal regions of the world what they are today. Leaving out of account past extinctions of Tertiary times, and considering only the extinctions that decimated the ranks of Pleistocene faunas, it becomes apparent that this factor has had a great deal to do with the characterization of North American and Eurasiatic mammalian assemblages. In the Old World there was a considerable degree of extinction at the end of the Pleistocene consequent upon the final retreat of the glaciers and the gradual establishment of neolithic and subsequent cultures in that area. In North America the extinction would seem to have been more extensive and probably more sudden. Recent evidence would seem to show that numerous typical Pleistocene mammals persisted in North America until post-Pleistocene or sub-recent times. Of these there may be mentioned specifically the mammoth, mastodon, horse, camel, royal bison, ground sloths, and *Tetrameryx*. These animals were all living when man reached this continent, ten, fifteen or twenty thousand years ago. Suddenly they were wiped out. Was this remarkable extinction of such large and numerous forms due to the advent of a new, aggressive animal, Man, who in some way may have upset a delicate ecological balance?

SECTION OF BIOLOGY

March 13, 1939

Doctor John Eric Hill, American Museum of Natural History: *The Geography of African Rodents.* (This lecture was illustrated by lantern slides.)

Africa lies chiefly in the tropics, more so than any other continent, but has a wide variety of climate due to various elevations, distances from the sea, and oceanic currents. Life zones based on temperature are not evident in Africa; the correlation between mammalian and bird faunal areas are primarily with rainfall and vegetation.

The faunal divisions proposed by Wallace and others have been considerably modified by students of African Zoölogy, and the summation and map by Dr. James P. Chapin of the American Museum, Department of Ornithology (Bull. Amer. Mus. Nat. Hist., 65, 83–93), can be used as a basis for mammalian geography with but few modifications.

Africa, north of the central Sahara Desert, is predominantly Palearctic, closely related faunally with southern Europe and Asia Minor. Three divisions of this may be noted: the Atlantan, including temperate North West Africa; the Egyptian, including the lower Nile Valley; and the Saharan, the northern three-fourths of that desert.

Africa, south of the Sahara, forms the Ethiopian Faunal Region, and is divided into West and East African Subregions. The West African Subregion includes most of Africa west of the Rift Valley, between 10° North and 10° South Latitudes. The rest of the Ethiopian Region, roughly between the Sahara and the Congo, from Senegal to the Red Sea, east of the Rift Valley and south of 10° South Latitude, forms the East African Subregion.

Madagascar has very little in common faunally with Africa.

The rodent fauna of Africa is very rich, and relatively distinct. Except for the Palearctic region in the north few genera

are found both in Africa and elsewhere. At least eleven families are represented, and five of these are at present found only in Africa: Anomaluridæ, Pedetidæ, Ctenodactylidæ, Thryonomyidæ and Bathyergidæ. The Muridæ are world-wide; the Sciuridæ are absent only from the Australian and Oceanic Regions. The Myoxidæ, Spalacidæ, and Hystricidæ are Palearctic and Oriental as well as African; and the Dipodidæ are Palearctic.

Subfamilies peculiar to Africa are: Xerinæ, African ground squirrels; Lophiomyinæ, maned rats; Dendromurinæ, tree-mice; Otomyinæ, swamp-rats. The tree squirrels belong to a group found also in the Oriental Region and many of the murine groups have relatives in that region.

The African tree squirrels as a group are found throughout Africa south of the Sahara desert, except in the most arid parts of the Somali District and in the South West Arid District. No one genus is found through this area, and all except *Paraxerus* are West African, either exclusively or extending into a few marginal districts of the East African Subregion. The Ethiopian ground squirrels are found in the drier districts: the Atlantan District, the Sudanese Savanna from Gambia to Eritrea, the Somali Arid District, parts of the Eastern Veld, and the South West Arid District.

The Anomaluridæ, including the aberrant Idiurinæ, have been found nowhere outside of Africa. Two species of *Anomalurus* occur in the Eastern Montane District; the others are all confined to the West African forest and to parts of the savanna districts. Six species occur in the Guinea Forest, of which three are restricted to it. The Congo and Cameroons Forest have seven species in common. The small *Zenkerella insignis,* the sole form without gliding membrane in the family, is found only in the Cameroons District.

The Pedetidæ, with the single genus *Pedetes,* the springhaas or jumping hare, is found only in Southeastern, Rhodesian and East African Veld Districts.

The Myoxidæ, dormice, are found throughout Africa, except in the Egyptian, Saharan, and Abyssinian Highland Districts.

The Spalacidæ get into northeastern Africa. *Spalax,* the northern mole-rat, occurs only in Egypt, but *Tachyoryctes,* the bamboo-rat, occurs in the Eastern Montane and High Veld Districts.

The Muridæ, mice, are represented in Africa by a great many forms.

The Microtinæ, Holarctic in distribution, occur only in the Atlantan District in Africa.

The Cricetinæ is represented by a single genus in the Southeastern Veld and in the southern part of the Eastern High Veld.

The Lophiomyinæ, maned rats, with cricetine teeth and unique skull, occur in East Africa from the Sudan to Tanganyika.

The Gerbillinæ, jumping rats of cricetine relationships, are found throughout Africa except in the forest and mountain districts. The most extreme genera of the subfamily and the largest number of genera are found in Africa, which may be the center of origin for this group.

The Murinæ, true mice, are found throughout Africa. The genera or groups of related genera are rarely confined to a single Subregion, although none except *Rattus* are found through all the districts.

The Dendromurinæ, with reduced cusp pattern on the molar teeth, are chiefly of the East African Subregion. Four genera extend into the West African Savanna Districts, and two genera are restricted to the Congo and Cameroons Forest Districts respectively.

The Otomyinæ, with large third molars bearing many lophs, are chiefly South African, but the typical genus extends through much of the Eastern Subregion and as far into the Western as the Cameroons. Several genera live in the dry bush of South West Africa.

The Dipodidæ, jerboas, are Palearctic, but extend into the dry Sudanese Savanna and the Somali Districts.

The Ctenodactylidæ, African rock-rats, are represented by different genera in the Atlantan, Saharan, Western Sudanese

Arid, Somali Arid, and South West Arid Districts. A Pliocene species of *Pectinator* is known from India.

The Thryonomyidæ, cane rats, are confined to the Ethiopian Region, where they are found in all districts except the Abyssinian Highland, Somali and South West Arid.

The Bathyergidæ, African mole-rats or blesmols, are chiefly South African, but peculiar genera are found in the Somali and Eastern Veld and Lowland Districts, and one genus reaches Togo and the Sudan. A bathyergid is known from the Oligocene of Mongolia.

The Hystricidæ, Old World porcupines, are represented by two genera. *Hystrix* is found throughout Africa as well as in the Oriental and Southern Palearctic. *Atherurus,* confined to West Africa in the Ethiopian Region, is found also in the Oriental.

Rattus rattus, the black rat, and *Hystrix* are found practically throughout Africa. Only one other rodent is found in all districts of the Ethiopian Region, *Mastomys,* the African hut-mouse. A few genera are confined to single districts, and in such cases the district is usually of extreme climate. The moist Guinea Forest has two endemic genera: *Myrsilus,* a tree squirrel, and *Dephomys,* a tree rat. The Cameroons Forest has two restricted types: *Zenkerella,* the scaly tailed mouse-squirrel, and *Prionomys,* a tree mouse. The Congo Forest has one genus, *Deomys,* a large tree mouse. The Abyssinian Highland has two genera: *Stenocephalomys,* a water rat, and *Desmomys,* one of the African meadow mice. *Xerus,* a ground squirrel, *Ammodillus* and *Microdillus,* gerbils, *Heterocephalus,* the naked mole-rat, and *Pectinator,* a large rock rat, are confined to the Somali Arid District. *Geosciurus,* a ground squirrel, *Gliriscus* and *Graphiurus,* dormice, *Petromyscus,* a rock mouse, *Bathyergus,* the sand mole-rat, and *Petromys,* the dassie-rat, are found only in the South West Arid District.

There is little evidence in favor of a South African Subregion. All genera peculiar to South Africa have related genera elsewhere in the East African Subregion or throughout

Africa, except possibly *Petromys,* which is not certainly a ctenodactylid.

In general the Ethiopian fauna is relatively distinct from that of all other regions. Apparently the closest affinity is with the Oriental Region, especially if the paleontological evidence is considered. In all probability the hystricomorphs of Africa are independently derived from primitive northern hystricomorph rodents, and resemblances with the South American types are parallel rather than indicative of close relationship.

SECTION OF PSYCHOLOGY

MARCH 20, 1939

DOCTOR GEORGE K. BENNETT, Psychological Corporation of New York: *Psychological Factors in Secretarial Success.*

A survey of previous research in the prediction of capacity to learn shorthand and typewriting reveals no basis for the selection of potentially successful students in this field. Both commercial high schools and private secretarial schools admit large proportions of inept pupils. The incidence of failure is in the vicinity of forty per cent among those schools requiring reasonable commercial competence for graduation. Under these circumstances, any method that will discriminate between the better and worse candidates for this type of training should have significance for both the individual candidate and society.

This investigation of secretarial aptitude was begun in 1932. The first battery of tests included standard measures of intelligence, personality, English grammar and a specially constructed miniature test of typewriting. This battery was used in a private school in New Haven. The criterion was typewriting speed. None of the paper and pencil tests yielded a significant correlation, but the miniature test correlated above .6. Complete scores were available for only forty-seven subjects.

The following year the experiment was repeated with some changes in the same school. Shorthand and accounting proficiency were added as criteria. The American Council on Education Psychological Examination was used as an intelligence test in the hope that the artificial language section would serve as a predictor of shorthand aptitude. The miniature typewriting test was retained. This investigation started with ninety-eight subjects in the fall and ended with only twenty-four the following May. Some students failed and others left school for sundry reasons. Many of those who remained

dropped one or more of the three major courses. So far as any conclusions could be drawn from the results of so few subjects the miniature test again predicted typewriting capacity and none of the tests predicted shorthand. Accounting grades appeared to have some relationship to arithmetic test scores.

In the fall of 1934 a third attempt at this type of prediction was made. One hundred twenty-six girls in New Haven Commercial High School were tested during the first weeks of training in stenography and typewriting by means of the miniature typewriting test, the Otis Group Intelligence Test and an experimental shorthand aptitude test. This measure was intended to approach the shorthand process by requiring the subject to translate digits into essentially meaningless symbols and subsequently to transcribe, by hand, these symbols into digits. Criterion scores, obtained the following spring, consisted of typewriting speed and shorthand vocabulary knowledge. Multiple correlations were in the vicinity of .3 for both typewriting and shorthand. Low positive correlations were obtained between the intelligence scores and both criteria. The new shorthand test appeared to predict both shorthand and typewriting better than did the cumbersome miniature typewriting test.

This study produced negligible positive results, although it demonstrated the futility of attempting this type of research without the full cooperation of the school authorities and a much larger number of subjects.

In 1937 such an opportunity presented itself. A large private secretarial school of high standards became concerned with the high incidence of failure among its students and permitted us to test the entire entering class of six hundred. This class is divided almost equally between high school graduates qualified for college entrance and students who have completed one or more years of college. Two tests were used with these subjects. The first was a group test modification of the analogous shorthand test previously used. The second was a test of recognition and correction of misspelled words occurring in business correspondence. The miniature typewriting test was

discontinued because it was unsuited for group use. An intelligence test appeared unnecessary in view of the rigid educational requirements.

Success or failure at the end of the first year of instruction was used as a criterion. Seventy per cent attained sufficient competence to be awarded a certificate and thirty per cent did not. This measure of success is more arbitrary than a speed criterion but it offers the compensating advantages of complete objectivity and appreciable practical value.

Complete data for 505 girls were obtained. Of these 211 had previously had some instruction in either typewriting or shorthand. These were treated as one group and the remaining inexperienced girls as a second group. Correlations between test scores and success were almost exactly equal for both groups. The spelling score correlated .48 and the shorthand score .27. The multiple correlation was .54 for each group. Students with previous stenographic training scored no higher on the tests, but had an increased incidence of success. This yields a tetrachoric correlation of .2 and increases total prediction to approximately .6. Because of the large number of subjects and small number of variables the multiple correlation has a small standard error and can be relied upon at least for that school.

Although a correlation of .6 is not highly efficient from a theoretical standpoint, it may have good practical value. Establishing regression equations to estimate probability of success and applying these to the five hundred cases we obtained the following results: Of those predicted as having

25% or less probability of success —17% succeeded
25% to 50% probability of success —45% succeeded
50% to 75% probability of success —68% succeeded
75% or greater probability of success—89% succeeded

This school has facilities for about 80 per cent of its applicants. Since students are accepted in order of application if they possess the required education it is reasonable to assume

equal aptitude for the entire group. If the results of these tests are used to eliminate the poorest fifth of the applicants, 80 per cent of those admitted may be expected to acquire satisfactory skill.

This is not a completed study. We plan to add to these two tests others of English, vocabulary and intelligence in the hope that some of these may contribute to prediction.

NEW MEMBERS

Elected March 6, 1939

SUSTAINING MEMBERS

Altamura, Mario R., Organic Chemist, Woodbury, N. J.

Becket, Frederick M., D.Sc., LL.D., President, Union Carbide & Carbon Research Laboratories, Inc., New York, N. Y.

Malcolm, Wilbur G., Ph.D., Executive Director, Lederle Laboratories, Inc., Pearl River, N. Y.

ACTIVE MEMBERS

Abramson, Harold Alexander, M.D., Assistant Professor, Physiology, Columbia University, New York, N. Y.

Alexander, Jerome, M.S., Consulting Chemist and Engineer, New York, N. Y.

Bauer, Johannes Henrik, M.D., Director, Laboratories of the International Health Division, Rockefeller Foundation, New York, N. Y.

Blain, Alexander W., M.D., Attending Surgeon, Alexander Blain Hospital, Detroit, Mich.

Blanchard, Kenneth C., Ph.D., Associate Professor, Biology, New York University, New York, N. Y.

Boyden, Alan A., Ph.D., Associate Professor, Zoology, Rutgers University, New Brunswick, N. J.

Brill, Norman Q., M.D., Member, Neuropsychiatric Staffs, Montefiore, Morrisania, Post Graduate and Sydenham Hospitals, New York, N. Y.

Condit, D. Dale, M.A., Geologist, Standard Vacuum Oil Co., New York, N. Y.

Conway, Catherine, Psychologist, New York, N. Y.

Cowley, William H., Ph.D., LL.D., President, Hamilton College, Clinton, N. Y.

Halpern, Joseph B., B.S., Tutor, Geology, Brooklyn College, Brooklyn, N. Y.

Heidelberger, Michael, Ph.D., Chemist to Medical Service, Presbyterian Hospital; Associate Member, Rockefeller Institute, New York, N. Y.

Macht, Maurice L., B.S., Chemist, Supervisor Research, Plastics Division, E. I. duPont De Nemours & Co., Arlington, N. J.

Martin, Walton, M.D., Clinical Professor, Surgery, Columbia University, New York, N. Y.

Paige, Sidney, Senior Geologist, N. Atlantic Division, U. S. Army Engineers, New York, N. Y.

Pease, Marshall Carleton, M.D., Clinical Professor, Pediatrics, N. Y. Post Graduate Medical School and Hospital, Columbia University, New York, N. Y.

Pickels, Edward G., Ph.D., Staff Member, International Health Division, Rockefeller Foundation, New York, N. Y.

Reeside, John B., Jr., Geologist in Charge, Paleontology and Stratigraphy, U. S. Geological Survey, Washington, D. C.

Schubert, Maxwell P., Ph.D., Chemist, Rockefeller Institute, New York, N. Y.

Simpson, Ray H., Ph.D., Instructor, Psychology, Barnard College, New York, N. Y.

Smyth, Charles Phelps, Ph.D., Professor, Chemistry, Princeton University, Princeton, N. J.

Weinstock, Harry I., M.D., Psychiatrist, Beth Israel Hospital, New York, N. Y.

Zahnd, Hugo, Ph.D., Assistant Professor, Chemistry, Brooklyn College, Brooklyn, N. Y.

ASSOCIATE MEMBERS

Beard, Howard H., Ph.D., Professor, Biochemistry, Louisiana State University, School of Medicine, New Orleans, La.

Bernheim, Frederick, Ph.D., Associate Professor, Physiology and Pharmacology, Duke University, School of Medicine, Durham, N. C.

Bertucci, Emile Augustus, M.D., Medical Examiner, Orleans Parish School System, New Orleans, La.

Bethea, Oscar W., M.Phar., Professor, Clinical Medicine, Tulane University, New Orleans, La.

Bittner, John J., Ph.D., Research Associate, Jackson Memorial Laboratory, Bar Harbor, Maine.

Blayney, James Roy, D.D.S., Director, Zoller Memorial Dental Clinic, University of Chicago, Chicago, Illinois.

Boyden, James R., Norwalk, Calif.

Brewer, N. R., Department Fellow, Physiology, University of Chicago, Chicago, Ill.

Bridwell, John Colburn, B.S., Entomologist, U. S. National Museum, Washington, D. C.

Brougher, John C., M.D., Instructor, Surgery, Medical School, University of Oregon, Eugene, Oregon.

Brown, Thomas R., M.D., Associate Professor, Medicine, Johns Hopkins University, Baltimore, Md.

Brown, V. E., Ph.D., Paleobotanist, Devereux, Ga.

Day, Harold M., B.S., Research Chemist, Cos Cob, Conn.

Dedell, Thomas R., B.S., Graduate Student, Physical Chemistry, Yale University, New Haven, Conn.

Devney, Dorothy Claris, M.A., Instructor, Zoology, College of St. Scholastica, Duluth, Minn.

Johnston, John C., B.A., Graduate Student, Geology, University of Wyoming, Laramie, Wyoming.

Knox, Arthur S., Instructor, Geology and Paleobotany, Tufts College, Medford, Mass.

Kindwall, J. A., M.D., Staff Member, Clifton Springs Sanitarium, Lochland School, Geneva, N. Y.

Lauffer, Max A., Jr., Ph.D., Assistant, Physical Chemistry, Rockefeller Institute, Princeton, N. J.

Leonardon, E. G., Geologist, Schlumberger Well Surveying Corporation, Houston, Texas.

Lochman, Christina, Ph.D., Instructor, Geology, Mt. Holyoke College, South Hadley, Mass.

McCollum, Leonhard F., Geologist, Carter Oil Company, Tulsa, Okla.

Marble, John Putnam, Ph.D., V. Chairman, Research Council, Division Geology and Geography, Washington, D. C.

Olmsted, Elizabeth Warren, Assistant, Geology, Smith College, Northampton, Mass.

Ploger, Louis W., Assistant Professor, Geology Department, Syracuse University, Syracuse, N. Y.

Postel, A. Williams, Lecturer, Geology and Mineralogy, University of Pennsylvania, Philadelphia, Pa.

Price, Llewellyn J., Museum of Comparative Zoology, Cambridge, Mass.

Rider, Charles R., Geologist, Drilling and Exploration Co., Amarillo, Texas.

Rogers, Cleaves L., A.B., Graduate Student, Geology, Princeton University, Princeton, N. J.

Speed, Carleton D., Jr., B.S., President, Speed Oil Company, Houston, Texas.

Young, Walter Jorgenson, Ph.D., Head Department, Philosophy and Psychology, Mary Washington College, Fredericksburg, Va.

Zuck, Theodore Thomas, M.D., Acting Professor, Anatomy, Western Reserve University, Cleveland, Ohio.

STUDENT MEMBER

Marion, Stephen P., A.M., Teacher, Brooklyn College, Brooklyn, N. Y.